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TITLE: METHOD AND APPARATUS FOR ASSEMBLING REFASTENABLE ABSORBENT GARMENTS

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METHOD AND APPARATUS FOR ASSEMBLING REFASTENABLE ABSORBENT GARMENT

BACKGROUND

The present invention relates generally to a refastenable absorbent garment, and in particular, to a method and apparatus for assembling refastenable absorbent garments.

Absorbent garments can be configured in many different forms. For example, absorbent garments can be configured as a pant-type, pull-on garment, or as a diaper-type product that is drawn up between the legs and fastened about the waist with various fastening systems. Pant-type, pull-on garments are often provided with various elastic elements that can conform to the body of the user and provide a comfortable, snug fit. Such garments, however, often do not have a refastenable mechanism that allows the garment to be easily removed after use or to be adjusted during use.

On the other hand, diaper-type products, which can be configured with fastening systems that allow the user to detach and reattach various fasteners so as to provide a refastenable absorbent garment, often are not configured with various elastic elements, for example around the waist, and may not conform well to the body of the user and/or may provide a bulky appearance beneath the user's garments. Moreover, such garments are typically produced as an "open" product, which is open at the sides and which cannot be pulled on like a pant-type garment. Some consumers prefer a pull-on type garment, since the garment is applied to the user like conventional underwear. Therefore, there remains a need for an improved absorbent garment, and in particular a pant-type garment, that is refastenable and provides a snug fit with a non-bulky appearance.

In addition, manufacturing facilities are often configured to fabricate one particular type of product. As such, these facilities may not provide the flexibility to transition between fabricating a conventional pull-on type garment and fabricating a refastenable, pull-on type garment using a single manufacturing line

or asset. Therefore the need also remains for improved methods and assemblies for manufacturing refastenable absorbent garments.

SUMMARY

Briefly stated, in one aspect, the invention is directed to a method for assembling a refastenable absorbent garment. In one preferred embodiment, the method comprises moving a base web in a first machine direction, moving at least two strips of fastener material in a second machine direction, cutting the at least two strips of fastener material to define at least a first and second stream of a plurality of fastener members, successively rotating each of the fastener members in each of the first and second streams, and applying each of the rotated fastener members in each of the first and second streams to the base web, wherein the fastener members in the first stream are sequentially located relative to the fastener members in the second stream on the base web in an alternating relationship along the first machine direction.

In one preferred embodiment of the invention, the method further comprises moving a continuous absorbent garment subassembly in a first machine direction, wherein the continuous absorbent garment subassembly comprises a continuous front body panel web, a continuous rear body panel web and a plurality of discrete crotch portions spaced along the first machine direction and extending between the continuous front and rear body panel webs. The method further comprises moving a fastener material in a second machine direction, cutting the fastener material to define a plurality of fastener members, successively rotating each of the fastener members, and applying each of the rotated fastener members to one of the continuous front and back panel webs.

In yet another preferred embodiment, the method further comprises cutting the base web along a cross direction and attaching the fastener member to the base web on opposite sides of the cross direction cut. In one preferred embodiment, the cross direction cut is formed as a perforation.

In another aspect of the invention, an apparatus for fabricating a refastenable absorbent garment includes a rotator adapted to rotate at least one of a

first and second fastener, and a construction drum rotating about an axis and positioned adjacent the rotator. The construction drum is adapted to carry the base web as it moves in a machine direction and is further adapted to receive at least one of the rotated first and second fasteners on the base web as the base web is carried by the construction drum.

In one preferred embodiment, the rotator comprises a first rotator adapted to rotate the first fastener and a second rotator adapted to rotate the second fastener, wherein the second rotator is positioned downstream of the first rotator. In another preferred embodiment, a single rotator is adapted to simultaneously rotate the first and second fasteners at the same time.

The present invention provides significant advantages over other absorbent garments and methods and apparatus for the manufacture thereof. For example, in one embodiment of a pant-type garment, the user can pull the garment on or off like underwear. However, by making the absorbent garment refastenable, it can be applied without needing to pull the garment on or off like a pant-like garment, if desired. For example, the garment can be pulled on like a pant-type garment, and removed like a diaper-type product by disengaging the fastener members and breaking the lines of weakness. Alternatively, the garment can be pulled on and off like a pant-like garment, and can thereafter be converted to a refastenable garment, if desired. For example, the garment can be made bigger or smaller simply by adjusting the positioning of the fasteners. Moreover, in one particular application, wherein the garment is used by adults, for example with occasional incontinence problems, the garment can be pulled up or down by the user, or the fastening system may be disengaged and engaged repeatedly by the user while the garment remains unsoiled over an extended period of time.

In one preferred embodiment, the absorbent garment includes elastic elements extending along the waist region. The elastic elements provide a snug, comfortable fit that does not create a bulky appearance beneath the user's outer garments. The combination of the refastenable fasteners with the elastic elements further enhances the fit and appearance of the garment.

The process and apparatus also provide significant advantages. For example, the manufacturer can easily switch between the manufacture of a non-refastenable, pant-type product and a refastenable product simply by introducing a fastener material, or a plurality of fastener members, and applying those fastener members to one or both of the front and rear body panels. Other modules may be added or omitted as desired. For example, various cutters may be introduced to make various cross direction cuts, e.g., perforations, in the front or rear body panel, and various bonders and rotators can be introduced to align and apply the fastener members. In this way, the machinery and equipment used to fabricate the body panels and crotch portion can be integrated into both processes, thereby maximizing the use of the assets and reducing the costs and space needed for the manufacturing facility.

The present invention, together with further objects and advantages, will be best understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a perspective view of one embodiment of a refastenable absorbent garment in a fastened configuration.

FIGURE 2 is top plan view of another embodiment of a refastenable absorbent garment prior to side seams being formed.

FIGURE 3 is an enlarged partial view of a side of one embodiment of a refastenable absorbent garment.

FIGURE 4 is an enlarged top plan view of a fastener material being cut in a machine direction.

FIGURE 5 is a schematic side view representation of an apparatus for and method of fabricating a portion of one embodiment of a refastenable absorbent garment.

FIGURE 6 is a partial schematic top view representation of one preferred method of fabricating a portion of one embodiment of a refastenable absorbent garment.

FIGURE 7 is a partial schematic top view representation of a method of fabricating another portion of one embodiment of a refastenable absorbent garment.

FIGURE 8 is a partial schematic top view representation of alternative preferred method of fabricating a portion of one embodiment of a refastenable absorbent garment.

FIGURE 9 is a partial top view of a base web with a pair of fastener members applied thereto in an alternative configuration.

FIGURE 10 is a partial schematic side view representation of an apparatus for and method of fabricating a portion of one embodiment of a refastenable absorbent garment.

FIGURE 11 is a partial schematic side view representation of an apparatus for and method of fabricating a portion of one embodiment of a refastenable absorbent garment.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

Referring to FIG. 2, it should be understood that the term "longitudinal," as used herein, means of or relating to length or the lengthwise direction **502**, and in particular, the direction running between the front and back of the user. The term "lateral," as used herein means situated on, directed toward or running from side to side, and in particular, a direction **500** running from the left to the right of a user, and vice versa. The terms "upper," "lower," "inner," and "outer" as used herein are intended to indicate the direction relative to the user wearing an absorbent garment over the crotch region, while the terms "inboard" and "outboard" refer to the directions relative to a centerline **8** of the garment. For example, the terms "inner" and "upper" refer to a "bodyside," which means the side closest to the body of the user, while the terms "outer" and "lower" refer to a "garment side."

The term "bodyside" should not be interpreted to mean in contact with the body of the user, but rather simply means the side that would face toward the body

of the user, regardless of whether the absorbent garment is actually being worn by the user and regardless of whether there are or may be intervening layers between the component and the body of the user. Likewise, the term "garment side" should not be interpreted to mean in contact with the garments of the user, but rather simply means the side that faces away from the body of the user, and therefore toward any outer garments that may be worn by the user, regardless of whether the absorbent garment is actually being worn by a user, regardless of whether any such outer garments are actually worn and regardless of whether there may be intervening layers between the component and any outer garment.

The term "machine direction" means the direction of flow as the various members and webs progress along the fabrication line and process. It should be understood that various separate members or webs can each be traveling in a machine direction, but with the various machine directions not necessarily being parallel or oriented in the same direction. For example, one web may be traveling a first machine direction, which is substantially perpendicular to the travel of another web in a second machine direction.

The term "cross direction" means the direction substantially perpendicular to the machine direction.

The term "downstream" means that one item is positioned more closely to the output or finished product end of the machine and/or process relative to another item. Conversely, the term "upstream" means that an item is positioned more closely to the input end of the machine or process relative to another item. For example, the output end is downstream of the input end, and vice versa, the input end is upstream of the output end.

The phrases "removeably attached," "removeably attaching," "removeably connected," "removeably engaged," "releasably attached," "releasably connected," or "releasably engaged," and variations thereof, refers to two or more elements being connected or connectable such that the elements tend to remain connected absent a separation force applied to one, both or all of the elements, and where the elements are capable of being separated upon the application of a separation force.

The required separation force is typically beyond that encountered while wearing the absorbent garment.

The phrases "fixedly secured," "fixedly engaged," "fixedly attached," "fixedly connected," and variations thereof, refers to two or more elements being connected or connectable such that they are not disconnected or otherwise separated, and are not intended to be separated or disconnected, during the normal operation and use of the absorbent garment.

The term "web" refers to a continuous stream of material, whether made from one or more layers or substrates, and regardless of whether it may have non-continuous, discrete items disposed thereon.

Referring to FIGS. 1 and 2, an absorbent garment **2** includes a first, front body panel **4** and a second, rear body panel **6**. The term "body panel" refers to the portion(s) of the absorbent garment, whether made of one or more layers or substrates or of one or more pieces or components, that is/are fitted circumferentially around at least the waist region of the user, including for example the user's lower back, buttock, hips and abdomen. The first and second body panels each have an inner, bodyside surface **10** and an outer, garment side surface **12**. The first, front body panel **4** has a length, which is measured between opposed first and second terminal edges **16** and **20**, and which is less than the overall length of the absorbent garment. Likewise, the second, rear body panel **6** has an overall length, which is measured between opposed first and second terminal edges **14** and **18,** and which is also less than the overall length of the absorbent garment. Each of the first and second body panels has an outboard edge **24, 28** formed along the outer periphery of laterally opposed side portions of the first and second body panel. It should be understood that the outboard edges of the front and rear body panels can be different lengths.

In one embodiment, shown in FIG. 2, each of the second body panel includes a tapered edge **26** on each side thereof that forms in part the leg opening, along with the side edges of the absorbent composite and the terminal edge **16** of the first body panel. It should be understood that the first body panel also could be configured with tapered side edges.

Referring to FIGS. 1 and 2, one or more, and preferably a plurality, meaning two or more, laterally extending elastic elements **36** are secured to each of the first and second body panels. Preferably, a plurality of laterally extending elastic elements are longitudinally spaced across substantially the entire length of the waist portion of the rear body panel **6**, although they may be spaced across a lesser length.

In one embodiment, shown in FIG. 2, the front body panel has a "non-elasticized" area **77** wherein there are no laterally extending elastic elements, or other elastic or elastomeric backing members, incorporated therein or making up any portion of the thickness or cross-section of the body panel at that area, such that the material can be gathered. Alternatively, the front body panel can have a plurality of laterally extending elastic elements spaced longitudinally along the entire length thereof, or along lesser lengths. For example elastic elements can extend along the upper waist portion and along the lower terminal edge defining the leg opening. It should be understood, that in an alternative embodiment, one or more separate waist bands, with or without elastic elements, can be secured to one or both of the rear and front body panels, preferably along the upper terminal edges thereof. Similarly, separate leg bands can be secured along the edges of the body panels and absorbent composite that define the leg openings. Alternatively, one or both of the body panels can be formed without any elastic elements.

Referring to FIG. 1, the front body panel preferably has a "deactivated" area **17** wherein the elastic elements are severed, chopped or otherwise deactivated, for example by using a rotary die cutter, by melt-breaking (e.g. with a heated or ultrasonic function roll) or by any other means known to those skilled in the art. In one preferred embodiment, the deactivated area **17** or landing zone is formed along a center portion of the front body panel and underlies a discrete landing member **100** and a pair of fastener members. One or more leg elastic elements **38** can be secured along the inner terminal edges **16**, **20**, **18**, **14** of the body panels **4**, **6** and an absorbent composite **50** to form a gasket with the leg of the user at the leg opening **120** formed by the absorbent garment.

The various waist and leg elastic elements can be formed from rubber or other elastomeric materials. One suitable material is a LYCRA® elastic material. For example, the various elastic elements can be formed of LYCRA® XA Spandex 540, 740 or 940 detex T-127 or T-128 elastics available from E.I. duPont De Nemours and Company, having an office in Wilmington, Delaware.

Each body panel is preferably formed as a composite, or laminate material, otherwise referred to as substrates or laminates, with the plurality of elastic strands sandwiched therebetween. Preferably two or more layers are bonded with various adhesives, such as hot melt, or by other techniques, including for example and without limitation ultrasonic bonding and heat pressure sealing. In one embodiment, the two layers are made of a non-woven material. It should be understood that the body panels can be made of a single layer or substrate of non-woven material, or can be comprised of more than two layers or substrates. Of course, it should be understood that other knitted or woven fabrics, non-woven fabrics, elastomeric materials, polymer films, laminates and the like can be used to form one or more of the body panel layers. The term "non-woven" web or material, as used herein, means a web having a structure of individual fibers or filaments that are interlaid, but not in an identifiable manner and without the aid of textile weaving or knitting, as in a knitted or woven fabric.

In one embodiment, the non-woven layers or substrates, and also a landing material **102**, can be made by spunbonding. Spunbond nonwoven webs or materials are made from melt-spun filaments or spunbonded fibers which refers to small diameter fibers that are formed by extruding molten thermoplastic material as filaments from a plurality of fine, usually circular capillaries of a spinneret with the diameter of the extruded filaments then being rapidly reduced, for example, by non-eductive or eductive fluid-drawing or other well known spunbonding mechanisms. The production of spunbound nonwoven webs is described in U.S. Patent No. 4,340,563 to Appel et al., U.S. Patent No. 3,692,618 to Dorschner et al., U.S. Patent No. 3,802,817 to Matsuki et al, U.S. Patent No. 3,502,763 to Hartmann, U.S. Patent No. 3,276,944 to Levy, U.S. patent No. 3,502,538 to Peterson, and U.S. patent No. 3,542,615 to Dodo et al, all of which are

incorporated herein by reference. The melt-spun filaments formed by the spunbond process are generally continuous and have diameters larger than 7 microns, more particularly, between about 10 and 30 microns. Another frequently used expression of fiber or filament diameter is denier, which is defined as grams per 9000 meters of a fiber or filament. The fibers may also have shapes such as those described in U.S. Patent No. 5,277,976 to Hogle, et al, U.S. Patent No. 5,466,410 to Hills and U.S. Patent Nos. 5,069,970 and 5,057,368 to Largman et al., all of which are incorporated herein by reference. The spunbond filaments usually are deposited, by one or more banks, onto a moving foraminous belt or forming wire where they form a web. Spunbonded filaments generally are not tacky when they are deposited onto the collecting surface.

Spunbond fabrics typically are stabilized or consolidated (pre-bonded) in some manner immediately as they are produced in order to give the web sufficient integrity to withstand the rigors of further processing into a finished product. This stabilization (prebonding) step may be accomplished through the use of an adhesive applied to the filaments as a liquid or powder which may be heat activated, or more commonly, by compaction rolls. As used herein, the term "compaction rolls" means a set of rollers above and below the web used to compact the web as a way of treating a just produced, melt-spun filament, particularly spunbond, web, in order to give the web sufficient integrity for further processing, but not the relatively strong bonding of secondary bonding processes, such as through-air bonding, thermal bonding, ultrasonic bonding and the like. Compaction rolls slightly squeeze the web in order to increase its self-adherence and thereby its integrity.

An alternative means for performing the pre-bonding step employs a hot air knife, as described in U.S. Patent No. 5,707,468, which is incorporated herein by reference. Briefly, the term "hot air knife" means a process of pre-bonding a just produced melt-spun filament, particularly spunbond, web, in order to impart the web with sufficient integrity, i.e., increase the stiffness of the web, for further processing. A hot air knife is a device that focuses a stream of heated air at a very high flow rate, generally from about 300 to about 3000 meters per minute

(m/min.), or more particularly from about 900 to about 1500 m/min., directed at the nonwoven web immediately after its formation. The air temperature usually is in the range of the melting point of at least one of the polymers used in the web, generally between about 90° C. and about 290° C. for the thermoplastic polymers commonly used in spunbonding. The control of air temperature, velocity, pressure, volume and other factors helps avoid damage to the web while increasing its integrity.

The hot air knife's focused stream of air is arranged and directed by at least one slot of about 3 to about 25 millimeters (mm) in width, particularly about 9.4 mm, serving as the exit for the heated air towards the web, with the slot running in a substantially cross-machine direction over substantially the entire width of the web. In other embodiments, there may be a plurality of slots arranged next to each other or separated by a slight gap. The at least one slot usually, but not necessarily, is continuous, and may be comprised of, for example, closely spaced holes. The hot air knife has a plenum to distribute and contain the heated air prior to its exiting the slot. The plenum pressure of the hot air knife usually is between about 2 to about 22 mmHg, and the hot air knife is positioned between about 6.35 mm and about 254 mm, and more particularly from about 19.05 to about 76.20 mm above the forming surface. In a particular embodiment, the hot air knife plenum's cross-sectional area for cross-directional flow (i.e., the plenum cross-sectional area in the machine direction) is at least twice the total slot exit area.

Since the foraminous wire onto which the spunbond polymer is formed generally moves at a high rate of speed, the time of exposure of any particular part of the web to the air discharge from the hot air knife typically is less than a tenth of a second and generally about one hundredth of a second, in contrast with the through-air bonding process, which has a much longer dwell time. The hot air knife process has a great range of variability and control over many factors, including air temperature, velocity, pressure, and volume, slot or hole arrangement, density and size, and the distance separating the hot air knife plenum and the web.

The spunbond process also can be used to form bicomponent spunbond nonwoven webs as, for example, from side-by-side (or sheath/core) linear low density polyethylene/polypropylene spunbond bicomponent filaments. A suitable process for forming such bicomponent spunbond nonwoven webs is described in U.S. Pat. No. 5,418,045 to Pike et al., which is incorporated herein by reference in its entirety.

Commercially available thermoplastic polymeric materials can be advantageously employed in making the fibers or filaments from which pattern-unbonded nonwoven material is formed. As used herein, the term "polymer" shall include, but is not limited to, homopolymers, copolymers, such as, for example, block, graft, random and alternating copolymers, terpolymers, etc., and blends and modifications thereof. Moreover, unless otherwise specially limited, the term "polymer" shall include all possible geometrical configurations of the material, including, without limitation, isotactic, syndiotactic and random symmetries. As used herein, the terms "thermoplastic polymer" or "thermoplastic polymeric material" refer to a long-chain polymer that softens when exposed to heat and returns to its original state when cooled to ambient temperature. Preferably, the spunbond fibers are made of a polypropylene. Other alternative thermoplastic materials include, without limitation, poly(vinyl chloride)s, polyesters, polyamides, polyfluorocarbons, polyolefins, polyurethanes, polystyrenes, polyethylenes, poly(vinyl alcohol)s, caprolactams, and copolymers of the foregoing. The fibers or filaments used in making the nonwoven material may have any suitable morphology and may include hollow or solid, straight or crimped, single component, bicomponent or multicomponent, biconstituent or multiconstituent fibers or filaments, and blends or mixes of such fibers and/or filaments, as are well known in the art.

After the nonwoven web is formed, the pre-bonded or unbonded web is passed through a suitable process or apparatus, including for example a calendar roll, to form a pattern of discrete bonded areas. The term "discrete" as used herein means individual or disconnected, and is contrasted with the term "continuous" as used in U.S. Patent No. 5,858,515 to Stokes et al, which is hereby incorporated

herein by reference, and which describes pattern-unbonded, or point un-bonded nonwoven fabrics having continuous bonded areas defining a plurality of discrete unbonded areas. In one embodiment, the calendar stack (not shown) includes an anvil roll and a pattern roll, which is heated and includes various raised landing portions. The raised portions of the pattern roll thermally bond the fibers to form the bonded areas. The bonds can made of any shape and size. Preferably, the percent bonded area of the web is between about 5% and 25% of the area of the web, and is more preferably between about 10% and 15%. Thereafter, the bonded substrate can be bonded to another substrate with the elastic members disposed therebetween.

In one alternative preferred embodiment, the landing material **102** is made of the point-unbonded nonwoven material, for example, a 2.0 osy point-unbonded material. One exemplary material of this type has been used in a HUGGIES® Ultratrim Disposable Diaper, which is commercially available from Kimberly-Clark Corporation. In another preferred embodiment, the landing material, which can be comprised of a portion of one of the body panel substrates, e.g., a body panel liner, is made of a non-woven material, for example, a spunbond material having a basis weight of preferably about 0.6 osy. In other preferred embodiments, the basis weight of each substrate can be between at least about 0.3 and about 2.0 osy, and preferably between about 0.5 osy and about 1.5 osy, and more preferably between about 0.5 osy and about 1.0 osy. Even with a relatively low percent area bonding, the relatively low basis weight non-woven material exhibits strength and tear characteristics allowing it to be used as a body panel. Other materials that may be used as the non-woven material include various meltblown materials, and also bonded-carded materials.

In other alternative embodiments, the landing material can be made of a loop material, which typically includes a backing structure and a plurality of loop members extending upwardly therefrom. The loop material can be formed from any suitable material, such as acrylic, nylon or polyester, and can be formed by such methods as warp knitting, stitch bonding or needle punching. Suitable loop

materials are available from Guilford Mills, Inc., Greensboro, North Carolina, U.S.A. under the trade designation No. 36549.

The body panel **4, 6** non-woven material is preferably substantially hydrophobic, which may optionally be treated with a surfactant or otherwise process to impart a desired level of wettability and hydrophilicity. In one particular embodiment of the invention, the body panel is a nonwoven, wire-weave spunbond polypropylene fabric composed of about 1.6 denier fibers formed into a web having a basis weight of about 0.6 osy. One suitable non-woven material is the Corinth 0.60 osy, 1.6 dpf wireweave, nonwettable Metallocene (EXXON ACHIEVE 2854 PP) spunbond material manufactured by Kimberly-Clark Corporation, the assignee of the present application.

Referring to FIGS. 1-3, fastening members **42** are preferably attached to the front body panel and extend laterally inboard relative to the outboard side edge **24** of the front body panel **4** from an attachment location **45**, which is preferably spaced inboard from the side edge. In the embodiment shown in FIG. 1, the front body panel **4** includes a middle portion **33**, having a landing member **100** secured thereto, and opposite side portions **35**. Opposite longitudinally extending lines of weakness **37** separate the middle portion **33**, with the landing member **100** attached thereto, from the opposite side portions **35**, such that the side portions **35** are initially breakably attached to opposite sides of the middle portion **33**. The lines of weakness **37** can comprise a perforation or other series of cuts, a thinning, breakage or separation of material, or a strip of a different kind of material bridging between the middle portion and the side portions that is more easily torn or broken than the material of the middle portion and side portions, which allow a user or the manufacturer to separate the side portions from the middle portion. For example, the absorbent garment can be broken after the garment is applied to a user, or beforehand. Preferably, the fastening members **42** are secured to the garment-side surface **12** of the side portions **35**, preferably in a portion of the deactivacted area or zone **17**, between the side edge **24** of the front body panel and the line of weakness **37**. The elastic elements in the side portions that are not deactivated allow the side portions to be stretched to provide a snug fit around the

user. In other embodiments, the front body panel, including the side portions, may not incorporate any elastic elements, or may incorporate a limited number spaced across various portions of the length thereof, as explained herein.

It should be understood that, in other embodiments, the fastening members can be secured to the rear body panel and engage the front body panel or, conversely, can be secured to the front body panel and engage the rear body panel. For example, and referring to FIG. 8, the fastener members **42** are shown as secured to a rear body panel web **148**. When separated into discrete absorbent garments, the fastener members **42** releasably engage the front body panel **4**, or a landing member disposed thereon. Preferably, in this embodiment, the side edges of the front and rear body panels are not fixedly secured to one another to form a side seam, such that the product remains "open," and is not initially pulled on like a pant-type product, unless the fastener members are first joined with the opposite body panel to form and define the leg openings. Preferably, in such an embodiment, there are no lines of weakness.

In another alternative embodiment, the fastening members can be secured to the rear body panel and can include a portion crossing over a line of weakness formed along the front body panel, or alternatively along the rear body panel, and can refastenably engage a portion of the front body panel on the other side of the line of weakness. In one embodiment, the fastening members engage the body panel along at least a portion that is not elasticized. It should be understood that the line of weakness could be formed at the side seam separating the front and rear body panels. Preferably, the fastening members are fixedly secured to the outer, garment-side surface of the front and/or rear body panels, and releasably engage the outer, garment-side surface of the front and/or rear body panels, although it should be understood that the fastening members could be fixedly secured to an inner, body-side surface of front and/or rear body panels and releasably engage an inner, body-side surface of the front and/or rear body panels. For example, in FIG. 8, the fastener members **42** are fixedly secured to an inner, bodyside surface of the rear body panel web, which is cut to form the rear body panels.

Referring to the embodiment of FIG. 2, the middle portion **33** does not include a separate landing member secured thereto. Instead, the front body panel itself serves as a landing material. Again, opposite longitudinally extending lines of weakness **37** separate the middle portion **33** from the opposite side portions **35**, such that the side portions **35** are initially breakably attached to opposite sides of the middle portion **33**. Preferably, the fastening members **42** are secured to the garment-side surface of the side portions **35** between the side edge **24** of the front body panel and the line of weakness **37**.

Referring to FIG. 1, in one embodiment, the opposite side edges **24** of the front body panel **4** are joined to the opposite side edges **28** of the rear body panel **6** to form a seam **39**. The seam **39** is formed by bonding, sewing or otherwise attaching the side edges. For example, in one preferred embodiment, the side seams are formed by ultrasonic bonds. In this way, prior to the breaking of the line of weakness **37**, the absorbent garment can be configured as a pant-like garment, which can be pulled over the legs of the user. After the garment is applied to the user, the lines of weakness can be broken, if desired, or left intact, as the fasteners are adjusted to fit the garment to the user. If desired, the lines of weakness can be broken prior to securing the garment to the user, for example when the user is bed-ridden. In this configuration, the garment is laid beneath the user and is secured to the user with the fastening tabs. By providing the side portions, and by connecting the fastening tabs to the front body panel, instead of the rear body panel, the tabs are located at the front of the user so as to not provide discomfort to the user when lying on their backs and to allow the fasteners to be more easily seen and adjusted by the user or caretaker.

It should be understood that the lines of weaknesses and the fasteners can be moved laterally inboard and outboard to provide more or less adjustment capability. In addition, the elasticized side portions of the embodiment in FIG. 1 can provide further adjustment capability.

In an alternative embodiment, shown for example in FIG. 8, the lines of weakness are omitted altogether, and the side edges **24**, **28** of the front and rear body panels are not fixedly joined to form a side seam. Instead, the fastener

members fixedly secured to one of the front and rear body panels releasably engage the other of the front and rear body panels to thereby join the front and rear body panels and define the leg openings for the user.

It should be understood that the front and rear body panels can be made as an integral unitary member that extends along the crotch from the front to back and with the sides thereof connected to form side seams. Alternatively, the front and rear body panels can be formed integrally as a ring-like member, for example as one body panel extending around the waist and hips of the user, that is attached to a crotch portion that forms leg openings.

In one alternative embodiment, an outer cover is disposed over the entire garment and forms the outer garment side layer or substrate of the front and rear body panels, with the various elastic elements **36**, **38** disposed between a bodyside liner on each of the front and rear body panels, which liner preferably is configured as a single substrate, and the outer cover, which is also preferably configured as single substrate. In this way, the portion of the outer cover that overlies the front body panel liner and is fitted around the front of the user forms part of the front body panel, while the portion of the outer cover that overlies the rear body panel liner and is fitted around the rear of the user forms part of the rear body panel. The front and rear body panels, with the liners and with the outer cover forming portions thereof and preferably extending therebetween, forms a chassis. The outer cover is preferably made of a non-woven material, similar to that of the other body panel materials described herein. It should be understood that the body panels, including the outer cover, can be configured with any number of a plurality of substrates, and that the body panels can include other layers and substrates.

Preferably, as shown in FIGS. 1-3, the fastening members **42** comprise a carrier member **43** that is formed in a generally side-ways, "U" shape, with a vertical extending base member **55** and a pair of laterally extending and longitudinally spaced tab members **47**. The carrier member can include a single tab member, or more than two tab members. The carrier members are preferably fixedly secured to the side portions of the front body panel **4** with adhesive bonds

49, sonic bonds, thermal bonds, pinning, stitching or other known types of attachment, as shown for example in FIGS. 1-3. In alternative embodiments, the fastening members can be fixedly secured to the rear body panel, as shown in FIG. 8, or to one or both of the front and rear body panels, *e.g.,* at the seam.

In a preferred embodiment, the pair of fastener members **42** used to releasably secure the front and rear body panels define a "fastening system," which refers to the grouping of fastener members used to releasably secure two or more portions of an absorbent garment. Although the fastening system is shown as being configured with two fastener members, it should be understood that it could include additional fastener members, and that the two-fastener member fastening system shown in the Figures is meant to be illustrative rather than limiting. For example, the fastening system could include three, four or even more fastener members.

Referring to FIG. 8, the fastener members **42**, and in particular the carrier members **43**, are fixedly connected to the rear body panel base web **148**, and after separation, the rear body panel. The tab members **47** can be oriented toward each other on either of the front and rear body panels, as shown in FIG. 8, or away from each other as shown in FIG. 9. In the embodiment shown in FIG. 8, the fastener member **42** and tab members **47** are rotated about the attachment location **45** so that they can engage the front body panel. In the embodiment of FIG. 9, the tab members **47** are already oriented for engagement with the front body panel.

Each carrier member **43** has a longitudinal length and each of the tab members **47** comprises a refastenable portion or an engagement portion having a longitudinal length. The refastenable portion **51** preferably comprises an array of hooks, as explained below, but alternatively can comprise various adhesives, such as pressure sensitive adhesives, buttons, zippers, snaps and other releasable and reattachable fastening devices known to those skilled in the art.

In one embodiment, shown in FIGS. 1-3, each fastening member **42** is comprised of two separate, longitudinally spaced tab members **47**. In any of the embodiments, the two or more tab members provides a pant-like fit that controls the waist and leg openings in the front and back of the garment, and also allows

the user to adjust the fit of the garment without totally undoing the garment. For example, the user can release one of the tab members and refasten it without undoing the other tab member.

In one preferred embodiment, the refastenable portion **51** comprises a hook-type fastener member, or hook strip, which is secured to the carrier member **43** with adhesive, ultrasonic bonding, stitching or other known attachment devices. The end portion **53** or tip of the carrier member can be left uncovered by the refastenable portion **51**, such that it can be lifted or flexed and grasped by a user as they disengage or peel back the fastener member. It should be understood that the term "hook" as used herein means any element capable of engaging another element, and is not intended to limit the form of the engaging elements, for example to include only "hooks," but rather encompasses any form or shape of engaging element, whether unidirectional or bi-directional. Various hook configurations are described in U.S. Patent No. 5,845,375 to Miller et al., U.S. Patent No. 6,132,660 to Kampfer, U.S. Patent No. 6,000,106 to Kampfer, U.S. Patent No. 5,868,987 to Kampfer, U.S. Patent No. 4,894,060 to Nestegard, and U.S. Patent No. 6,190,594 B1 to Gorman, the entire disclosures of which are incorporated by reference herein. Some examples of hook fasteners are the various CS600 hook fasteners, including the XKH-01-002 CS600, 2300 Pin Density hook fastener (Part No. XKH-01-002/60MM/SP#2628), manufactured by Minnesota Mining and Manufacturing Co., St. Paul Minn. Another example of a hook fastener are the Velcro® HTH-851 and HTH-829 hook fasteners available from Velcro USA, Inc.

In one preferred embodiment, a mushroom-type hook strip comprises a homogeneous backing of thermoplastic resin and, integral with backing, an array of upstanding stems distributed across at least one face of the backing, each having a mushroom head. The array of hooks on each strip comprises an engagement portion having a longitudinal length. The stems can have a molecular orientation as evidenced by a birefringence value of at least 0.001, and the mushroom heads having circular disc shapes with generally planar end surfaces opposite the

backing, which disc shaped heads preferably have diameter to thickness ratios of greater than about 1.5 to 1.

The stems of the hook strip can be molecularly orientated as evidenced by a birefringence value of at least 0.001. As such, they have significantly greater stiffness and durability, as well as greater tensile and flexural strength, than would be achievable without such orientation. Because of these qualities, the portions of the stems not heated by a heating surface during the forming process remain resiliently flexible during a deforming step, which preferably involves the application of heat to the stem tips by contact with the heated surface of a metal roller. Such contact forms the tip of each stem into a circular disc shaped mushroom head at the tip of each stem, which head has a substantially flat inner surface that enhances its holding power when engaged with a loop.

As compared to hook strips that have unoriented stems, the enhanced strength of the hooks of the hook strip makes them less likely to break during disengagement. When the hook strip is used with the non-woven material herein described, the enhanced strength of the hooks makes them less likely to break under disengagement forces than the fibers of the material, a beneficial attribute for at least two reasons. First, broken hooks can create debris whereas a broken fiber typically does not. Furthermore, the non-woven material typically contains many more engageable fibers than there are hooks per unit area, thus allowing a greater number of disengagements before a hook-and-loop fastener becomes useless.

Although the stems of the hook strip preferably are generally circular in cross section, other suitable cross sections include rectangular and hexagonal. The stems preferably have fillets at their bases, both to enhance strength and stiffness and for easy release from a mold in which they are formed. In addition, the stems can be tapered, preferably from a larger to a smaller cross-section as one moves from the base to the head.

The stem portions are preferably at an angle of about 90 degrees from the backing substrate, however, this angle can range from about 80 to about 100 degrees, preferably 85 to about 95 degrees. The hook head portion is formed on

the distal end of the stem. The hook head can be elongated in on or more directions forming the fiber engaging portions. These fiber engaging portions extend outward from the stem portion at any angle so that they can project upwardly away from the film backing, parallel with the film backing or even downward toward the film backing.

For example, the hook head portion has a deformed fiber engaging portion that projects downward. Preferably, the lower surface of the fiber engaging portion also projects downward form a crook between the lower face of the fiber engaging portion and the stem base portion. In one preferred embodiment, the heads of the hooks generally project at a downward angle from the hook head top portions toward the base. This downward angle (measured from a reference line taken from the top of the hook head and parallel with the backing) is generally from about 0 to about 70 degrees, preferably from about 5 to about 60 degrees and most preferably from about 5 to about 35 degrees (defined by a linear extent running from a center region of the hook head top portion to an end of the hook head fiber engaging portion).

The head shape with its high diameter to thickness ratio, and the small size and close spacing or high density of individual hooks that are provided by the hook strip according to the present invention makes it able to easily firmly releasably engage non-woven materials in shear, possibly because the many thin heads can easily move radially into engagement with rather small fibers. Thus the hook strip is particularly useful for hook-and-loop fastening when the "loops" are provided by non-woven materials which are not particularly adapted for use as the loop portions of hook and loop fasteners, and which are not as well engaged by known prior art hook strips. For example, the hook strip is particularly well-suited for engaging the topographically flatter non-woven materials described above, including the non-woven spunbond material, which has relatively fewer loose, outwardly extending, free fibers than conventional loop materials, but still provides a relatively high number of pores, of sufficient size, such that the material can be engaged by the hooks. Indeed, once the hooks are received in the pores, or embedded in the non-woven material, the fastening tabs provide

excellent shear characteristics, such that the garment is securely fastened during normal wearing conditions.

In general, the hooks are of uniform height, preferably of from about 0.10 to 1.30 mm in height, and more preferably from about 0.18 to 0.51 mm in height; have a density on the backing preferably of from 60 to 1,600 hooks per square centimeter, and more preferably from 125 to 690 hooks per square centimeter, and preferably greater than about 150 hooks per square centimeter; have a stem diameter adjacent the heads of the hooks preferably of from 0.07 to 0.7 mm, and more preferably from about 0.1 to 0.3 mm. The deformed hook heads project radially past the stems on at least one side preferably by an average of about 0.01 to 0.3 mm, and more preferably by an average of about 0.02 to 0.25 mm and have average thicknesses between their outer and inner surfaces (i.e., measured in a direction parallel to the axis of the stems) preferably of from about 0.01 to 0.3 mm and more preferably of from about 0.02 mm to 0.1 mm. The hook heads have average head diameter (i.e., measured radially of the axis of the heads and stems) to average head thickness ratio preferably of from 1.5:1 to 12:1, and more preferably from 2.5:1 to 6:1.

For most hook-and-loop uses, the hooks of the hook strip should be distributed substantially uniformly over the entire area of the hook strip, usually in a square or hexagonal array.

To have both good flexibility and strength, the backing of the hook strip preferably is from 0.02 to 0.5 mm thick, and more preferably is from 0.06 to 0.3 mm in thick, especially when the hook strip is made of polypropylene or a copolymer of polypropylene and polyethylene. For some uses, a stiffer backing could be used, or the backing can be coated with a layer of pressure sensitive adhesive on its surfaces opposite the hooks by which the backing could be adhered to a substrate, such as the carrier member **43**, so that the backing could then rely on the strength of the substrate to help anchor the hooks.

Virtually any orientable thermoplastic resin that is suitable for extrusion molding may be used to produce the hook strip. Thermoplastic resins that can be extrusion molded and should be useful include polyesters such as poly(ethylene

terephthalate), polyamides such as nylon, poly(styrene-acrylonitrile), poly(acrylonitrile-butadiene-styrene), polyolefins such as polypropylene, and plasticized polyvinyl chloride. One preferred thermoplastic resin is a random copolymer of polypropylene and polyethylene containing 17.5% polyethylene and having a melt flow index of 30, that is available as SRD7-463 from Shell Oil Company, Houston, Tex.

The hook strip has preferably substantially continuous planar backing of thermoplastic resin. Integral with the backing is the array of hooks projecting generally at right angles to one major surface of the backing. Each of the hooks has a stem, and, at the end of the stem opposite the backing, a generally circular plate-like cap or head projecting radially past or overhanging the stem so as to form a fiber engaging portion that projects downward. Preferably, the lower surface of the fiber engaging portion also projects downward form a crook between the lower face of the fiber engaging portion and the stem base portion. The stem can also have a fillet around its base.

When the absorbent garment is secured to the user, the fastening members **42** secured to the side portions of the front body panels **4**, or elsewhere as described above, releasably engage or are otherwise connected to the landing member secured to the middle portion of the front body panel **4**. In particular, the heads on the hooks engage the fibers in the landing material. Alternatively, the fastening tabs **47**, or refastenable portions **57**, releasably engage the front body panel material, which acts as a landing material, without an additional landing member being secured thereto. In particular, the heads on the hooks engage the fibers of the body panel, whether elasticized or not, or alternatively the landing material making up the landing member. The refastenable portions **51** can be initially engaged with the fibers to form a mechanical bond with the body panel or landing member during the manufacturing process so as to help maintain the connection between the side and middle portions. Alternatively, as shown in FIG. 8, where the absorbent garment is preferably sold to the user as an "open product," the refastenable portions **51** are initially engaged with the body side surface **10** of the rear body panel, preferably with a mechanical bond, during the manufacturing

process so as to maintain the fastener member flat against the body panel such that it does not interfere with the folding and packaging process. When the user desires to put on the absorbent garment, the tab members **47** are peeled back so as to disengage the refastenable portion from the rear body panel. The fastener member **42** is rotated about the attachment location **45**, wherein the tab members **47** extend laterally outward and preferably outboard from the side edges **28**. The user then reapplies the refastenable portion **51** to the front body panel so as to releasably secure the front and rear body panels to one another about the user.

Referring to FIGS. 1, 2 and 7, the absorbent garment includes an absorbent composite **50** having first and second longitudinally opposed terminal end edges **60, 62**. The absorbent composite preferably includes a substantially liquid permeable topsheet **64**, or liner, and a substantially liquid impermeable backsheet **68**, or outer cover. A retention portion **70** is disposed or sandwiched between the topsheet and the backsheet, which are connected. The topsheet, backsheet and other components of the absorbent composite **50** can be joined for example with adhesive bonds, sonic bonds, thermal bonds, pinning, stitching or any other attachment techniques known in the art, as well as combinations thereof. For example, a uniform continuous layer of adhesive, a patterned layer of adhesive, a sprayed pattern of adhesive or any array of lines, swirls or spots of construction bonds may be used to join the topsheet and backsheet, or any of the other components described herein. It should be understood that the term "absorbent composite" refers to any material or assembly capable of absorbing liquids or bodily exudates, and may be comprised of a single material or component, for example a retention portion.

Additional layers, including for example, a surge layer **72**, are also preferably incorporated into the absorbent composite. Preferably, the surge layer does not run the entire length of the absorbent composite and is shorter than the retention portion. The topsheet can be indirectly joined to the backsheet by affixing the topsheet to intermediate layers, such as the surge layer or retention portion, which in turn is affixed to the backsheet. The absorbent composite may

also include barrier cuffs, or leakage control shields, formed along the opposite longitudinally extending edges of the absorbent composite.

The backsheet **68** is preferably liquid impermeable, but may be liquid permeable, e.g., when an additional barrier layer is used with the retention portion. For example, in one embodiment, the backsheet can be made from a thin plastic film, or other flexible, substantially liquid-impermeable material. As used herein, the term "flexible" means a material that is compliant and which will readily conform to the general shape and contour of the body of the user. The backsheet prevents various bodily fluids and exudates from wetting or otherwise contaminating various bedding or outer garments worn by the user over the absorbent garment. In particular, the backsheet can include a film, such as a polyethylene film, having a thickness of from about 0.012 mm to about 0.051 mm.

In various constructions, the topsheet can comprise various woven or nonwoven materials. For example, the topsheet can be composed of a meltblown or spunbonded web of desired fibers, and may also be a bonded-carded web. For example, the topsheet can be made of a substantially hydrophobic material, and the hydrophobic material may optionally be treated with a surfactant or otherwise processed to import a desired level of wettability and hydrophilicity. In one particular embodiment of the invention, the topsheet is a nonwoven, spunbond polypropylene fabric composed of about 2.8 - 3.2 denier fibers formed into a web having a basis weight of about 22 gsm and density of about 0.06 gm/cc. The fabric can be surface treated with an operative amount of surfactant, such as about 0.28% Triton X-102 surfactant. The surfactant can be applied by any conventional means, such as spraying, printing, brush coating or the like.

In various constructions, the backsheet can comprise a woven or nonwoven fibrous web layer, which is treated or constructed, partially or wholly, to impart the desired levels of liquid impermeability to selected regions that are adjacent to or proximate the absorbent retention portion. For example, the backsheet may include a gas-permeable, nonwoven fabric layer laminated to a polymer film layer which may or may not be gas-permeable. Other examples of fibrous, cloth-like backsheet materials can comprise a stretch thinned or stretch thermal laminate

material composed of a 0.6 mil (0.015 mm) thick polypropylene cast film and a 0.7 ounce per square yard (23.8 gsm) polypropylene spunbond material (2 denier fibers). A material of this type has been employed to form the outercover of a HUGGIES® Ultratrim Disposable Diaper, which has been commercially available from Kimberly-Clark Corporation. The backsheet can provide the outercover of the article, particularly in the crotch region. Optionally, however, the article may include a separate outercover component member, as disclosed herein, which is additional to the backsheet. The outercover can be joined, for example, to one or more of the absorbent composite and/or body panels as explained above.

The backsheet may include a micro-porous, "breathable" material which permits gases, such as water vapor, to escape from the absorbent garment while substantially preventing liquid exudates from passing through the backsheet. For example, the breathable backsheet may be composed of a microporous polymer film or a nonwoven fabric which has been coated or otherwise modified to impart a desired level of liquid impermeability. For example, a suitable microporous film can be a PMP-1 material, which is available from Mitsui Toatsu Chemicals, Inc., a company having offices in Tokyo, Japan; or an XKO-8044 polyolefin film available from 3M Company of Minneapolis, Minnesota. The backsheet may also be embossed or otherwise provided with a pattern or matte finish to exhibit a more aesthetically pleasing appearance.

In various configurations of the invention, where a component, such as the backsheet is configured to be permeable to gas while having a resistance and limited permeability to aqueous liquid, the liquid resistant component can have a construction which is capable of supporting a selected hydrohead of water substantially without leakage therethrough. A suitable technique for determining the resistance of a material to liquid penetration is Federal Test Method Standard FTMS 191 Method 5514, 1978, or an equivalent thereof.

In one preferred embodiment, the backsheet is sufficiently impermeable to liquid and semi-liquid materials to substantially prevent the undesired leakage of waste materials, defined as exudates, including for example urine and feces. For example, the backsheet member can desirably support a hydrohead of at least

about 45 centimeters (cm) substantially without leakage. The backsheet member can alternatively support a hydrohead of at least about 55 cm, and optionally, can support a hydrohead of at least about 60 cm, or more, to provide improved benefits.

The backsheet and/or outercover also can be extensible. In one preferred embodiment, the backsheet and/or outercover is capable of providing an elongation of at least about 1 cm when subjected to a tensile force of 11.8 g/cm, and further provides a substantially permanent deformation of at least about 20% when subjected to a tensile force of 19.70 g/cm and is then allowed to relax under a zero applied stress for a period of 1 minute.

For example, the extensible member can be composed of a necked fiber, a creped fiber, a micro-pleated fiber, polymer films or the like, as well as combinations thereof. The fabrics may be woven or nonwoven materials, such as spunbond fabrics. One example of a suitable extensible material is a 60% necked, polypropylene spunbond having a basis weight of about 1.2 osy.

The backsheet and/or outercover also can be expandable, for example when it has one or more folds, e.g., one or more z-folds (not shown), or can be both extensible and expandable. The term expandable as used herein means to enlarge or to increase the extent or area, lateral and/or longitudinal, thereof, e.g., by unfolding one or more folds.

The retention portion **70** is preferably made of an absorbent material, which can be any material that tends to swell or expand as it absorbs exudates, including various liquids and/or fluids excreted or exuded by the user. For example, the absorbent material can be made of airformed, airlaid and/or wetlaid composites of fibers and high absorbency materials, referred to as superabsorbents. Superabsorbents typically are made of polyacrylic acids, such as FAVOR 880 available from Stockhausen, Inc. of Greensboro, North Carolina. The fibers can be fluff pulp materials, such as Alliance CR-1654, or any combination of crosslinked pulps, hardwood, softwood, and synthetic fibers. Airlaid and wetlaid structures typically include binding agents, which are used to stabilize the structure. In addition, various foams, absorbent films, and superabsorbent fabrics

can be used as an absorbent material. Various acceptable absorbent materials are disclosed in U.S. Patents 5,147,343 for Absorbent Products Containing Hydrogels With Ability To Swell Against Pressure, 5,601,542 for Absorbent Composite, and 5,651,862 for Wet Formed Absorbent Composite, all of which are hereby incorporated herein by reference. Furthermore, the proportion of high-absorbency particles can range from about 0 to about 100%, and the proportion of fibrous material from about 0 to about 100%. Additionally, high absorbency fibers can be used such as Oasis type 121 and type 122 superabsorbent fibers available from Technical Absorbent Ltd., Grimsby, Lincolnshire, United Kingdom.

The retention portion **70** has laterally opposed side edges **74** and preferably can be made of a single or dual layer of absorbent material. The retention portion preferably has an hour-glass shape with enlarged end regions. Alternatively, the retention portion can include a folded or multi-layered configuration. The retention portion preferably has a length substantially equal to, or slightly shorter than, the length of the absorbent composite. The retention portion can include one or more barrier layers attached to the absorbent material. In one embodiment, an upper tissue substrate is disposed adjacent the retention portion. Alternatively, a lower tissue substrate can be disposed adjacent an opposite side of the retention portion, or the tissue can completely envelope the retention position.

Referring to FIG. 1, the opposite garment side of the end regions of the absorbent composite, and in particular, the outer, garment side surface of the backsheet **68**, are secured to the bodyside surface of the longitudinally opposed crotch ends of the first and second body panels **4, 6**, and in particular the liner portion of those body panels. It should be understood that the absorbent composite can be secured using any of the methods of attachment described above, including for example various adhesives, stitching or other bonding methods. The absorbent composite can be secured to the body panels with any configuration of attachment lines, swirls, patterns, spots, etc., or can be a full and continuous attachment therebetween. In addition, it should be understood that the absorbent composite can be attached to the garment side surface of the body panels.

Referring to FIGS. 4-7, one preferred method and apparatus for fabricating one or more embodiments of the aforedescribed refastenable absorbent garments is illustrated. Another preferred method and apparatus for fabricating one or more embodiments of the aforedescribed refastenable absorbent garments is illustrated. Although the processes are described in terms of various zones, it should be understood that they are continuous processes.

Referring to FIGS. 6 (zone A1) and 8 (zone A1), a roll of fastener material **104** provides a continuous supply or strip of fastener material moving in a machine direction. In one embodiment, shown in FIGS. 6 and 8, the fastener material includes a carrier material **106** forming outer lateral base portions and an engagement material **108** disposed along a middle portion of the carrier material to form the refastenable portion. The strip of fastener material is cut along the machine direction using a rotary die cutter, preferably in a serpentine cut, to form a pair of strips **110** of fastener material, each having a plurality of tab members **47** facing laterally inward toward the other strip of fastener material. The end portions of each tab member **47** preferably extend laterally beyond the engagement material and are formed only of the carrier material.

Referring to the alternative embodiment of FIG. 4, the fastener material includes a pair of laterally or cross direction spaced longitudinal deadened strips **97**, wherein the hooks are flattened, or the adhesive or other refastening mechanism are otherwise deactivated, such that the deadened strips **97** will not releasably engage a corresponding landing material. When cut, the deadened strips **97** can form the end portion of the tab, which can be grasped by the user to disengage the fastener from the landing material.

Referring to zone A2 of FIGS. 6 and 8, the strips **110** of fastener material are separated such that they are laterally spaced in the cross direction. The strips **110** are also aligned along the machine direction, with one or both of the strips being moved in the machine direction relative to the other, such that the tab members **47** are aligned in the cross direction directly opposite each other. In one embodiment, as shown in FIG. 6, the strips are spaced in the cross direction approximately the same distance that the fastener members are spaced along the

front panel of the absorbent garment, as shown in FIGS. 1 and 2. U.S. Patent No. 5,540,796, entitled Process for Assembling Elasticized Ear Portions and assigned to Kimberly-Clark Corporation, the entire disclosure of which is hereby incorporated herein by reference, discloses the cutting, separating, and aligning process.

As shown in the embodiment of FIG. 8, the strips **110** of fastener material are also flipped or rotated about an axis parallel to the machine direction, such that the plurality of tab members **47** on each strip are facing laterally outward relative to each other. Alternatively, the strips can be crossed over each other such that the tab member on each strip are facing laterally outward relative to each other. After being flipped or crossed, the strips are spaced approximately the same distance as the distance between them when they are applied to the front and/or rear body panel base web, as shown for example in FIG. 8.

In an alternative embodiment, shown in FIG. 5, the strips **110** are separated and are moved in a machine direction to different locations, and in particular a first and second position **202**, **204**, along the process line on opposite sides of a construction drum **134**.

It should be understood that the fastener material can be comprised of a single material that forms both the base portion and the refastenable portion, and that the term "base portion" is meant to refer to that portion of the fastener material that is secured to the front body panel **4** on the outboard side of the line of weakness **37**, preferably in a nonremovable relationship thereto. Preferably, engagement between the refastenable portion of the fastener material and the landing material, whether it be of a hook and loop engagement or an adhesive engagement, is the only type of engagement between those two members. Alternatively, as shown in FIG. 3, one or more secondary, breakable bonds **99** can be formed between the fastener member **42** and the landing member or front body panel on the inboard side of the line of weakness **37**. The breakable bond can be broken when the garment is put into use, for example, when it is desired to use the refastenable feature of the garment.

Referring to FIGS. 5 and 11 and zone A3 of FIGS. 6 and 8, each strip of fastener material **110** is successively cut along the cross direction to form two streams **208**, **210** of a plurality of fastener members **42**. As shown in FIGS. 5, 6, 8 and 11, for example, a perforation cut **118** can made with a perforation cutter **225**, **227**, such as a knife and anvil cutter. Alternatively, the cut can be a continuous cut, e.g., a slit, so as to completely separate successive fastener members in each stream. Preferably, the cuts **118** are made such that each fastener member **42** is formed with two tab members **47** having a pair of refastenable portions **51**. Of course, it should be understood that the cuts **118** can be spaced such that the fastener member has a single tab member, or more than two tab members. Referring to FIGS. 5 and 11, one or more adhesive applicators **206** apply a glue or adhesive to one side of the fastener members in each stream at the attachment locations **45** on the fastener members. The adhesive applicator **206** can be positioned upstream or downstream of the cutter **225**.

Referring to FIGS. 5, 6, 8 and 11, and in particular zone A4, each of the fastener members **42**, whether separated completely from the next successive fastener member, or partially connected thereto by way of a perforation, is rotated and accelerated and applied to one of the base webs **120**, **148** moving along in the process in a machine direction. The base web is made of one or more of the materials described above with respect to the body panels and preferably is made of two layers of a spunbond nonwoven material.

As shown in FIG. 5, the fastener members in the first stream **208** of fastener members are rotated with a first rotator **212** at the first location **202** adjacent the construction drum **134** and are applied to the base web **120**. The fastener members in the second stream **210** of fastener members are rotated with a second rotator **214** at the second location **204** positioned downstream of the first rotator **212** and first location, and spaced circumferentially around the surface of the construction drum, and are applied to the base web. The rotators **212**, **214** and construction drum **134** preferably rotate about parallel horizontal axes of rotation **216**, **218**, **220**. The base web **120, 148** with the first fastener members applied thereto passes through a nip **222** formed between the construction drum

and a press roller **224**. The nip aids in the engagement between the refastenable portion **51** and the base web **120, 148**. The rotated stream **210** of second fastener members are then sequentially applied to the base web **120, 148** alternatively spaced between the first fastener members at the second location **204**. The base web, whether the front body panel base web or the rear body panel base web, with both rotated streams of fastener members applied thereto in an alternating relationship, then passes through a second nip **226** formed between the construction drum **134** and a second press roller **228**. The nip **226** engages the refastenable portion of the fastener members with the base web.

The rotated first stream **208** of fastener members are applied to the base web **120, 148** with the tab members **47** facing upstream or downstream, while the sequentially spaced second rotated stream **210** of fasteners are applied with the tab members **47** facing the opposite direction, such that a plurality of pairs of fastener members are applied to the base web with the tab members **47** facing each other. Each pair of opposing fastener members defines a fastening system **230** for a particular absorbent garment, as shown in FIG. 1.

In an alternative embodiment, shown in FIG. 11, the strips **110** of fastener material are spaced and aligned as explained above. After the strips of fastener material are cut, as explained above, the opposing pairs of fastener members make up the plurality of fastening systems **230**, as shown in FIG. 6. The fastener members in each fastening system **230** are rotated simultaneously with a single rotator and are applied together onto the base web **120** as it is carried by the construction drum **134**. The base web with the fastening system applied thereto then passes through a nip **136** to further engage the refastenable portion of the fastener members with the landing material.

In yet another alternative embodiment, shown in FIG. 8, a pair of fastener members **42** is rotated simultaneously with a rotator. The pair of fastener members **42** includes one fastener member from one fastening system and one fastener member from a next successive fastening system. In this way, as successive pairs of fastener members are applied to the base web **148**, the fastening systems are completed with a first and second fastener member being

sequentially applied in an alternating relationship. In the preferred embodiment shown in FIG. 8, the fastening systems are applied to the rear body panel base web **148**, with the refastenable portion **51** initially engaged with the web material so as to form a temporary mechanical bond. As explained above, the tab members **42** are peeled away from the rear body panel and rotated about the attachment location, wherein they can be engaged with the front body panel. Accordingly, in the preferred embodiment of FIG. 8, the fastener members are preferably secured to the bodyside surface **10** of the rear body panel, although it should be understood that they could also be secured to the garment side surface. In addition, the fastening systems can be fixedly secured to the front body panel, with the refastenable portions releasably engaging the rear body panel during use.

In another preferred embodiment, shown in FIG. 2, the fastener members **42** are applied to the garment side surface of the front body panel **4**, wherein they bridge lines of weakness between a middle portion and side portions thereof as explained above. During the fabrication process, a pair of fastener members **42** is preferably rotated simultaneously with a rotator, although they can be rotated successively with a pair of rotators. The pair of fastener members **42** includes one fastener member from one fastening system and one fastener member from a next successive fastening system. In this way, as successive pairs of fastener members are applied to the front body panel base web **120**, the fastening systems are completed with a first and second fastener member being sequentially applied in an alternating relationship. As the fastening systems are applied to the front body panel base web **120**, the refastenable portion **51** initially engages with the web material, or landing member, so as to form a temporary mechanical bond.

As shown in FIGS. 5 and 11, the fastener members, whether rotated individually or together as a fastening system, are rotated using an offset cam action rotator or applicator **212**, **214**. The rotator includes a plurality of transfer segments **126**, which can have a vacuum applied thereto, that engage the fastener members. Coupler arms **127** connect the transfer segments and a drive ring. The coupler arm **127** includes a cam end having a cam follower that follows the profile of a cam mechanism. The profile of the cam mechanism can be readily changed to

change the desired speed output and pitch of the fastener members. Preferably, the streams **208**, **210** of fastener members are moving at a slower speed than the speed of the body panel web. The rotator can be configured to accelerate the fastener members between, for example, a 6 inch pitch and a 33 inch pitch. If the successive fastener members **42**, or fastening systems **230**, are separated by a perforation, the transfer segment **126** breaks the perforation as it engages the fastener member, or fastening system, and moves away from the next fastener member or fastening system, which is engaged by a next transfer segment **126**. Alternatively, the fastener members are already cut all of the way through, and the rotator merely moves, or separates, the fastener members of one fastening system from the fastener members of the next fastening system. In yet another alternative embodiment, the fastener members are cut and separated by the transfer segments, or pucks. In a preferred embodiment, the rotator rotates the end portion of the transfer segment, preferably approximately 90 degrees, about a radial axis, such that the fastener members or fastening systems are oriented in the cross direction as described above, as the transfer segments are rotated about a horizontal axis **218**, **220**. The rotator, and the method for the use thereof, is further disclosed in U.S. Patent Nos. 5,761,478, 5,759,340, and 6,139,004, all of which are assigned to Kimberly-Clark Worldwide, Inc., the assignee of the present application, and all of which are hereby incorporated herein by reference.

Alternatively, the fastener members can be rotated using a revolving transfer roll as shown and described in U.S. Patent No. 4,608,115, which is assigned to Kimberly-Clark Worldwide, Inc., the assignee of the present application, and which is hereby incorporated herein by reference.

Referring to FIGS. 5 and 6, the base web **120**, which preferably forms the front body panel, and which is preferably made of the one of the materials described above, is moved along in the process in a machine direction, which may be, but is not necessarily, parallel to the machine direction of the fastener material and streams of fastener members. At zone B1, an adhesive is applied to one side of a base web liner. Preferably, the adhesive is applied as a continuous adhesive layer, or intermittently as a continuous adhesive layer **128** and a microbead

adhesive layer **130**. Alternatively, the adhesive can be applied intermittently, with ultrasonic bonds connecting the substrates in the regions between the application of adhesive. The adhesive is preferably applied intermittently only when a landing member is being applied over the area of no adhesive or the area of microbead adhesive, which areas also preferably include deadened elastic elements.

Referring to FIGS. 5 and 6 (zone B2), the plurality of elastic elements **36** are applied between the base web liner **242** and an outer base web layer **244** with an elastic applicator **246** in one or more of the configurations described above. The body panel webs **120**, **148** shown in FIG. 8 can be fabricated in a similar fashion. The outer base web layer, which can formed from the outer cover, is adhered to the liner with the adhesive, or with other known devices such as ultrasonic bonds, thermal bonds, stitching and the like. For example, as shown in FIG. 1, the elastic elements are applied in the machine direction as they are spaced across the entire length (defined in the cross direction) of the base web. In particular, the elastic elements are applied between two substrates of the base web, e.g., a front body panel liner substrate and an outer cover substrate. At the same time, elastic elements are applied to another base web **148**, e.g., the rear body panel web, running parallel to the first body panel web. The body panel web, with the elastic elements disposed between the two substrates, is passed through a nip **248**. Various aspects for fabricating the absorbent garment, and for introducing the elastic elements, are shown and described in U.S. Patent No. 5,643,396, which is hereby incorporated herein by reference.

Referring to FIGS. 5 and 6, and in particular zone B3, the elastic elements **36** are preferably deactivated in the landing zone **17** with a timed elastic cutter **132**, preferably by severing or chopping the elastic elements. At the same time, the substrates making up the body panels are bonded, preferably by ultrasonic bonding. The elastic elements also can be deactivated at the attachment location on the rear body panel as shown in FIG. 8.

Referring to FIGS. 5 and 6 (zone C1), a landing member **100**, made of a landing material **102**, is applied to the base web and moves therewith in a machine direction. The landing material **102** can be made of any of the above-described

materials, including for example a point unbonded nonwoven material or a spunbond nonwoven material. The landing material **102** is slip cut using a cutter **634** to form the landing members, which are then applied to the base web in a spaced relationship. Adhesive can be applied to the landing material prior to its being cut. The landing material can also be made of various known loop materials as described above. Alternatively, if the fastener member is configured as a tape, the landing material preferably made of various known materials that interface with such tape. The landing material has opposite lateral side edges **112**.

In zone B4, a pair of cross direction cuts **140** spaced along the machine direction are made in the base web with a cutter **138** to form the lines of weakness **37**, preferably in the landing zone and preferably spaced inwardly from the outboard edges of the landing zone, and preferably on opposite sides of the landing member. It should be understood that in the preferred embodiment of FIG. 2, the landing member is omitted. As shown in FIGS. 5 and 11, the cuts can be made by the cutter **138** after the landing member is applied to the base web, or if no landing member is applied, at some time prior to it being applied to the construction drum. The cutter can be a knife and anvil cutter, or a laser, water jet or other type of cutter known to those of skill in the art.

Referring to FIGS. 5 and 6, and in particular zone C1, the fastener members are applied to the base web with the rotators **212**, **214** as the base web **120** wraps around and is carried by the construction drum **134**. Additional adhesive can be applied between the base web and fastener member if desired. The base portion **55** of each fastener member is applied to the base web **120** on the opposite side of the line of weakness **37** that the landing member **100** is applied, such that the fastener member **42** spans the lines of weakness **37**.

Alternatively, as shown in FIG. 10, the strips of fastener material **110** are rotated using a revolving transfer roll rotator, as explained above. In particular, the strips **110** are introduced between a cutting roll **600** and the transfer roll **602**. An adhesive is applied to the outer surface of the strips prior to their introduction to the transfer roll. The cutting roll **600** cuts the fastener material into the fastener members, which are then rotated by the transfer roll. An applicator roll **604** then

nips the fastener members to the body panel web, as the web passes between the applicator roll and transfer roll.

Referring to FIGS. 5, 10 and 11, the fastener members, once applied to the body panel base web with the rotator, are preferably bonded to the body panel web using one or more, and preferably two, ultrasonic bonders **620**. An exemplary ultrasonic bonder is the rotating horn and anvil type ultrasonic bonder disclosed in U.S. Patent No. 5,660,679, the entirety of which is hereby incorporated herein by reference. An alternative ultrasonic bonder is disclosed in U.S. Patent No. 6,123,792, the entirety of which is hereby incorporated herein by reference.

Referring to FIG. 7, and in particular, zone D1, the base web **120** is further secured to the absorbent composite **50**, which is also secured to the base web **148** that forms the rear body panel. In particular, the front panel base web **120** moves along a path parallel to the rear body panel base web **148** in machine direction. The absorbent composite **50**, extending in the cross direction, is then applied to the bodyside of each of the front and rear body panel base webs **120**, **148** to form a ladder type configuration, although it should be understood that the absorbent composite could be attached to the garment side of each body panel. The absorbent composite **50** can be assembled in a machine direction and can thereafter be rotated and applied to the front and rear body panel base webs. The absorbent composite can be incorporated either before or after the assembly of the base web described above. In one preferred embodiment, where the outer cover is secured to and forms part of the front and rear body panels and a crotch portion of the absorbent garment, the absorbent composite is applied to the body chassis after the outer cover and body panel liners are joined with the elastic elements disposed therebetween. The absorbent composite **50** is secured to the body panel base webs **120**, **148** by bonding and the like, including for example and without limitation adhesive, sonic and thermal bonding, stitching or by other devices known to those of skill in the art.

In one embodiment, where the front and rear body panels and absorbent composite are discrete members, leg openings are formed between the successive cross direction absorbent composites, which define the crotch portions. A die

cutter can be used to further define the shape of the body panels, for example the tapered edges **26**. In an alternative embodiment, where the outer cover defines in part the front and rear body panels, a die cutter can be used to successively cut leg openings in the outer cover between the absorbent composites to form the ladder type configuration with a plurality of crotch portions.

In one embodiment, shown in FIG. 8, an absorbent garment subassembly includes a front body panel base web and a rear body panel base web with a plurality of fastening systems applied to the rear body panel base web. Each fastening system includes a pair of fastening members attached to the rear body panel web between a pair of cuts **150**, which define the side edges **28** of the rear body panel **6** and the side edges **24** of the front body panel **4**. The cuts can initially be made as perforation cuts, with the discrete absorbent garments later being formed by separating the subassembly at the cuts. Alternatively, the cuts can be made after the tabs are applied and the subassembly is folded so as to completely separate the discrete absorbent garments.

Referring to FIG. 7 at zone D2, the crotch portion is folded such that the rear body panel base web **148** overlies and faces the front body panel base web **120**. Side seams **39** are formed, preferably by ultrasonic bonding, or with adhesive bonds, stitching or other suitable means known to those skilled in the art. In the embodiment of FIG. 8, the side seams are preferably omitted, such that the absorbent garment remains "open." At zone D3, a cross direction cut **150** is made through the side seam to separate the refastenable absorbent garments. As explained above, the side seam can also be omitted. The cut can be made with a knife and anvil. The refastenable absorbent garments can thereafter be folded and packaged for sale to the end user.

Various aspects of the process for making the absorbent garment are further disclosed in U.S. Application Serial No. 09/834,870, filed April 13, 2001, and entitled "Multiple Component Web," U.S. Application Serial No. 09/834,875, filed April 13, 2001 and entitled "Method of Assembling Personal Care Absorbent Article," U.S. Application Serial No. 09/834,869, filed April 13, 2001, and entitled "Pant-Type Personal Care Articles, and Methods of Making and Using Such

Personal Care Articles," U.S. Application Serial No. 09/834,787, filed April 13, 2001 and entitled "Methods of Changing Size of Pant-Type Personal Care Articles Outputted from a Manufacturing Process," and U.S. Application Serial No. 09/834,682, filed April 13, 2001 and entitled "Passive Bonds For Personal Care Article," the entire disclosures of which are hereby incorporated by reference.

In other aspects, the absorbent garment and the process for making the absorbent garment are further disclosed in U.S. Application Serial No. 60/303,307, filed July 5, 2001, and entitled "Refastenable Absorbent Garment," the entire disclosure of which is hereby incorporated by reference.

Although the present invention has been described with reference to preferred embodiments, those skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention. As such, it is intended that the foregoing detailed description be regarded as illustrative rather than limiting and that it is the appended claims, including all equivalents thereof, which are intended to define the scope of the invention.